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(56) Documents Cited

EP 0352755 A2 US 5188452 A

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(54) Lamp unit

(57) A lamp unit 1 comprising a first module 2 housing arc lamp bulb 18 and a second module 3 housing optical components 4-16, including a cross-fade colour system 9-11. The first and second modules may be thermally isolated by airflow provided by a fan (100, Figure 1B). The cross-fade colour system has at least two colour filter plates (75, Figure 9B) which may be moved independently in planes across the light beam path, the planes of movement of separate filter plates being angled to each other. The optical components 4-16 may be resiliently mounted. A copper magnetic ballast (92, Figure 11) forms the main structural base of the lamp.

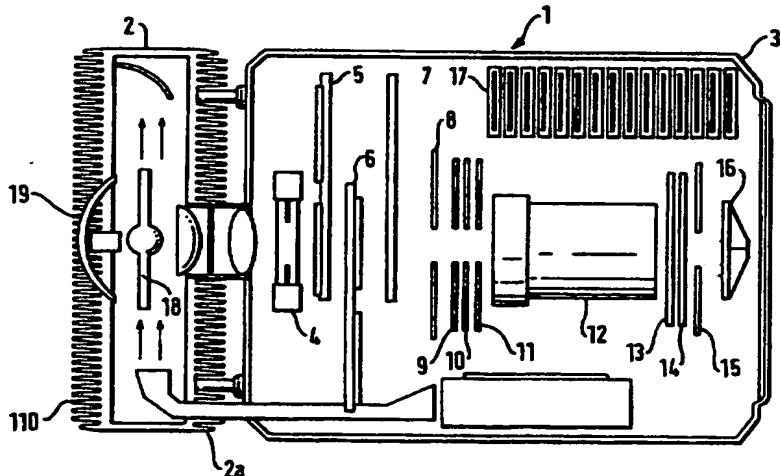


FIG.1A

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

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LAMP UNIT

The present invention relates to a new lamp unit. In particular, the present invention relates to a cross-fade colour system and to a lamp unit 5 incorporating such a cross-fade colour system. The invention also relates to a lamp unit having a novel arrangement of bulb housing, in particular one which is suitable for use in a high power arc lamp unit. Furthermore, the present application relates to a new 10 means for mounting optical components in a lamp unit.

Lamp units are used in a variety of situations. In particular, high power arc lamp units are widely used in stage lighting systems.

It is desirable to enable the light beam in a lamp 15 unit, and in particular high power arc lamp units used for lighting stages, to be coloured any colour, and to enable cross-fading between colours. In order to colour the beam, colour plates have been used. By progressively moving the colour filter into and out of 20 the beam, the beam can be tinted with the respective colour. By using colour plates of each of the secondary colours, namely cyan, magenta and yellow, any colour of light may be obtained by placing an appropriate combination of plates in the beam, and the 25 beam can be cross faded between any two colours.

Reference here is made to US Patent No. 4745531 (Cameleon).

A high power arc lamp bulb generates a large amount of heat during operation, and it is accordingly 30 necessary to cool the bulb. Previously, this has been achieved by providing a large volume surrounding the bulb to enable convection cooling, together with the operation of a fan to enable forced cooling of the bulb. However, the requirement for a large space 35 around the bulb increases the overall dimensions of the unit, and the use of a fan results in unacceptable

noise levels for some applications.

According to a first aspect of the present invention, there is provided a cross-fade system suitable for use in a lamp unit containing a light source which produces a light beam, said cross-fade system comprising at least two colour filter plates each of which is mounted such that it is capable of being moved in a plane across the path of the light beam independently of the other plate or plates thereby to alter the colour of the transmitted light, characterised in that respective planes in which adjacent colour plates move are angled with respect to each other.

By angling the planes in which adjacent colour plates move it is possible to ensure that unwanted reflections are diverted from the beam path whilst still retaining the full colour saturation. The angle between the respective planes of the adjacent plates is chosen in the light of the particular optical system in which the colour-fade system is placed. The angle chosen must be large enough so that over the optical path length distance between the colour plate and the lens the unwanted reflections are fully removed from the light beam. However the colour of light transmitted by colour plates, and in particular by dichroic plates, is dependent on the angle at which the light beam is incident on the filter, and the angle between respective planes of adjacent plates is chosen so that the light is incident on each colour plate at an angle at which the desired colour is transmitted. This angle will vary between different colour plates.

Normally, the colour plates are dichroic colour plates, known per se, of the three secondary colours, cyan, magenta and yellow to allow cross-fading between any two colours. Other combinations of two or more colour plates may be used, although other combinations

will not enable cross-fade between any two arbitrarily chosen colours, but only between colours in a subrange of all possible colours.

Each colour filter plate may comprise a pair of
5 filter shutter elements in the form of a shutter
mechanism, a gap being defined between the elements
which may be opened and closed by movement of one or
other or both of the shutters in the plane of the
shutter mechanism. When the gap is fully open, the
10 light beam passes uninterrupted. When the gap is
closed, the whole of the light beam must pass through
the closed filter elements. When the gap is partially
open, a part of the light beam must pass through a
15 colour filter. The range of colours is achieved by
varying the gap between each pair of shutter elements.

This first aspect of the invention also extends to
a lighting instrument for producing a plurality of
colours of light from a light source which produces a
light beam and comprising a cross-fade system having at
20 least two colour filter plates each of which is mounted
such that it is capable of being moved in a plane
across the path of the light beam independently of the
other plate or plates thereby to alter the colour of
the transmitted light, characterised in that respective
25 planes in which adjacent colour plates move are angled
with respect to each other.

According to a second aspect of the present
invention, there is provided a lighting instrument
comprising a light source which produces a light beam,
30 said instrument including a housing in which at least
one optical component is situated in the path of the
beam, characterized in that the or each optical
component is resiliently mounted in the housing.

By resiliently mounting the or each optical
35 component in the housing, it may be protected from
mechanical vibration during transit or during operation

of a stepper motor associated with that optical component or a stepper motor associated with a neighbouring optical component.

The or each optical component may be resiliently mounted between oppositely disposed locating means which locate respective formations in the optical component(s). Each of these formations in the optical component(s) may comprise a resilient locator means, which may comprise a spring in extension, which cooperates with the locating means so as to resiliently mount the or each optical component. The resilient locator means may be arranged so as to bridge a recess in the at least one optical component. This arrangement has the advantage that thermal insulation is improved owing to the minimal surface contact.

At least one of the locating means may be movable away from a position in which the or each optical component is resiliently mounted in order to permit easy access to the optical component and to enable easy demounting and exchange of the optical component. The easy demounting and exchange of optical components is highly desirable in many lamp applications, such as in lighting stages, because during use of the lamp the optical components become dirty and must be cleaned or replaced if optimum performance is to be obtained from the lamp.

The or each movable locating means may be provided with a locking mechanism to lock it in position in which the or each optical component is resiliently mounted. In this way the lamp unit may be made secure.

The or each locating means may be a longitudinal bar which extends in the direction of the beam. At least one of the bars may be hinged at its ends to permit movement of the bar from the position in which it locates the optical component(s) to one in which it is away from the optical component(s).

The housing may carry a number of optical components such as colour discs. In addition to the optical components described herein the housing may carry further optical components such as projector

5 slides, a beam shaping module and a diffusion module.

In the lighting instrument of this aspect of the invention, at least one of the optical components located in the path of the beam may be provided with integral electrical circuitry. This circuitry may

10 terminate in suitable contacts which permit connection of a drive means such as a motor associated with that optical component to the main electrical circuitry in the lighting unit. Suitable plug and socket connectors may be provided to facilitate connection of the main

15 electrical circuitry to the integral electrical circuitry on the optical component and/or connection of the integral electrical circuitry on the optical component to the associated drive means.

According to a third aspect of the present
20 invention, there is provided a lamp unit, comprising a lamp bulb and optical components, characterised in that the arc lamp is situated in a first housing which is thermally isolated from a second housing which houses the optical components. As a result, the influence of
25 heat generated by the lamp bulb on the optical components is reduced.

In this aspect of the invention, it is preferred that the lamp bulb is also cooled by a fan supplying ducted air to the lamp bulb. The air duct may be a
30 pressurised reducing diameter air duct whereby efficient cooling of the lamp bulb may be achieved with a minimum of fan noise.

The fan supplying ducted air to the lamp bulb may be remotely situated, preferably in the housing which
35 houses the optical components.

According to a fourth aspect of the invention,

there is provided metal casting provided with fins. The finned casting assists in heat transfer from the housing by convection cooling. Thermally insulating material, which may be any material with bad thermal 5 conduction, such as fibreglass, and is preferably lightweight may be provided between the first housing which houses the lamp and the housing which houses the optical components. In addition, the optical 10 components may be thermally isolated from the arc lamp bulb by a curtain of air between the bulb housing and the housing for the optical components. The air curtain may be created by the ducted air from the fan.

According to a fifth aspect of the invention, there is provided an arc lamp unit comprising a lamp 15 housing movably mounted on a base, a copper magnetic ballast being provided to ensure the provision of the correct drive voltage and current to the lamp, characterised in that the copper magnetic ballast forms part of the base of the lamp unit.

20 The arc lamp requires either a copper magnetic ballast as shown in Figure 11, or electronic supply to ensure the correct drive voltage and current. These units are normally available as an integral part of the fixture or as a separate plug-in unit. The magnetic 25 ballast is the most reliable option but the weight of the unit is increased due to the layers of iron and copper wire necessary in the magnetic ballast. Previously, therefore, it has been necessary to build a strong supporting structure in order to support the 30 heavy ballast and the lamp unit. As a result the overall weight of the lamp unit, magnetic ballast and supporting structure is high. This causes a strain on fixing devices which is a particular problem for suspended lights. By forming the base of the lamp unit 35 from the magnetic ballast, the lamp housing can be made much lighter and the overall weight of the unit can be

reduced.

Additionally, there is a good conduction path for the heat dissipated within the ballast to the existing mounting structure.

5 For a better understanding of the present invention, and to show how it may be brought into effect, reference will now be made, by way of example to the accompanying drawings, in which:

Figure 1A shows a high power arc lamp unit
10 including a bulb housing in accordance with an embodiment of the invention;

Figure 1B shows a high power arc lamp unit including a bulb housing in accordance with a further embodiment of the invention;

15 Figure 2 shows a rotating gobo module;

Figure 3 shows a colour wheel;

Figure 4 shows a shutter/strobe system;

Figure 5 shows the outline structure of the operating means for a dimmer, frosting and colour
20 tinting system;

Figure 6 shows a lens assembly;

Figure 7 shows a rotating prism;

Figure 8 shows the general arrangement of the cross fade colour system of this invention;

25 Figures 9A and 9B show the arrangement for the dichroic plates;

Figure 10 illustrates the securing arrangement for securing the optical components in the second module; and

30 Figure 11 shows the head yoke assembly.

The present invention will now be described with reference to the drawings.

Figure 1A shows a high power arc lamp unit 1 comprising a first module 2 for housing the arc lamp
35 bulb and a second module 3 for housing a number of different optical and effects components to provide a

number of different optical effects.

The light generated by the arc lamp bulb in the first module 2 is directed through the optical components 4-16 in the second module 3. The optical

5 components 4-16 in the second module 3 include iris 4, lens and focus systems 12 as well as systems 5-11,13-16 to create special effects, such as a cross-fade colour system 9-11.

Although the present embodiment of the invention 10 is described with regard to an arc lamp, the invention can be utilised with different lamps. The level of cooling required by the lamp bulb varies depending on the power of the lamp, and the cooling system employed should reflect this.

15 The bulb housing module 2 contains an arc lamp bulb 18 and a spherical concave cold mirror reflector mirror 19 which reflects the image of the arc lamp bulb 18 back onto itself as the primary optical units. The light from the arc lamp bulb 18 is then directed 20 through the optical components 4-16 in the second module 3 and is emitted from the front of the lamp, as indicated above.

The primary optical units are directly cooled via an air flow ducted from a fan 100 (illustrated in 25 Figure 2) situated in the second module 3. This air flow is directed axially along the arc lamp bulb 18 and is vented out through the rear of the lamp via light baffles (not illustrated). The diameter of the air flow exits is larger than the diameter of the duct in 30 the region of the bulb to reduce noise. This ducted air can therefore be made to flow at a fast rate by use of a progressively reducing diameter pressurised duct system. Since the air flow taken in by the fan is not as great as the air flow past the bulb, efficient 35 cooling can be obtained with a minimum of fan noise.

The casting 2a is also provided with fins 110 to

assist the heat transfer from the lamp. Thermally isolating materials are arranged so as to minimise direct heat transfer from the bulb housing in the first module to the optical components in the second module.

5 A further embodiment of the invention, in which heat transfer is further reduced by creating a curtain of air between the bulb housing module 2 and the optical components module 3 is shown in Figure 1B.

The optical components in the second module 3
10 include the beam iris 4; a rotating gobo wheel 5, 6; a colour wheel 7; a shutter/strobe arrangement 8; cross fade colour system cyan plate 9; cross fade colour system magenta plate 10; cross fade colour system yellow plate 11; triplet lens/focus assembly 12; dimmer
15 module 13; frost effect module 14; beam splitter 15; rotating prism 16 and function control cards 17. These optical components will now be described in greater detail.

The rotating gobo module 5, 6 is illustrated in
20 Figure 2. The rotating gobo module 5, 6 has a six position gobo wheel 16 coupled directly to stepper motor 12. The stepper motor 12 is configured so as to drive the gobo wheel 16 in either direction at a variable speed. An idler gear 19 is mounted
25 concentrically to the drive shaft of a further stepper motor 11 in such a way as to provide a damped, self centering, floating drive to the individual gobo holders 17, thus minimising noise caused by the action of the stepper motor drive. Nylon bearing surfaces 110
30 ensure a smooth running surface for the floating drive gear whilst the use of hard anodised wheels and gobo cups coated with antifriction coatings provide an efficient running surface without the need for conventional ball bearings thus adding to overall
35 weight reduction. This new driving arrangement for the gobo cups can be used in a gobo wheel used in any lamp.

The idler gear 19 is driven from a gear 13 mounted directly to stepper motor 11, and in turn drives the five gobo holder 17. This arrangement allows all of the gobo holders 17 to be rotated in either direction 5 at various speeds. Located within each holder 17 is a gobo 15 having an internal taper 111 and a spring retainer clip 112 which enables different gobos 15 having a variety of depths to be fitted to the same holder 17. Stepper motors 11 and 12 are mounted on the 10 rotating gobo plate 18.

The colour wheel 7 is illustrated in Figure 3. A 6 position colour wheel 7 is provided and is mounted on a colour wheel boss 25 which in turn is coupled directly to a stepper motor 21. The stepper motor 21 15 drives the colour wheel 7 at variable speeds in both directions and is mounted on the colour wheel plate 22. Located within the colour wheel 7 are five different dichroic colour filter disks 23 that colour the light beam when the filter disk 23 is placed within it.

20 The shutter/strobe system 8 is shown in Figure 4. Two stepper motors 31 mounted on a mounting plate 33, each stepper motor 31 being directly coupled to a blade 34. The blades 34 work in conjunction with each other so that, at the furthest spaced apart 25 position, the blades 34 allow all of the light through the spherical hole 37, and when the blades 34 are brought together no light passes through the spherical hole 37. The range of motion of the blades 34 is limited by the pins 32 mounted perpendicularly to the 30 stepper motor shaft, in conjunction with the stops 35 mounted on the plates 36. The stepper motors 31 may drive the blades 34 at various speeds, enabling stroboscopic effects to be produced.

The outline structure of the operating means for 35 the dimmer, frosting and colour tinting systems 13,14,15 is shown in Figure 5.

Each module has a pair of plates 48 attached to rods 43. Rods 43 have a short section of geared rack 42 at one end and run on a bearing block 47 for support at the other end. Each section of rack 42 is meshed with 5 a gear mounted directly to a stepper motor 41. The plates 46 are constrained to run in track guides 44. The stepper motor 41, track guides 44, and bearing block 47 are mounted on mounting plate 46.

As will easily be appreciated, as the stepper 10 motor 41 is operated, the rack sections 42 are driven in opposing directions so as to move the pair of aluminium plates 48 into and out of the path of the beam.

The colour split module 15 is mounted as outlined 15 above, such that orientation of the blade is the same direction as the cross-fade blades and the splitter module is placed in the optical path where the cross-fade colour blade effects are not yet evenly distributed over the light beam, thus effectively 20 creating colour banding as opposed to colour mixing and the effect of moving the split colour blades into the light beam is to tint part of the beam, thus giving a split colour effect.

The dimmer module 13 is mounted within the head 25 such that the orientation of the blades is in a direction different from the cross-fade blades, and is placed in the optical path where the cross-fade colour blade effects are distributed in the light beam, i.e. at the position shown in Figure 1, and thus has no 30 effect on the colouration of the beam. The movement of the aluminium plates 48 into and out of the light beam reduces the light intensity passing through the dimmer module as appropriate.

The frost effect module 14 is mounted within the 35 head in the position shown in Figure 1 in the same manner as the dimmer module, and so also has no effect

on the colouration of the beam. Each aluminium plate 48 has a semicircular cut-out which are covered by frost filters 45.

The lens assembly 12 is shown in Figure 6. The 5 triplet lens 51 is mounted on a carrier 57 which runs back and forth on sliders 54 attached to the main focus bracket 56. The lens carrier 57 is driven by a stepper motor 53 by means of the drive rod 55. The focus mechanism is secured within the head via two sprung 10 plates, as shown in Figure 10. The focus mechanism allows the triplet lens to focus on the beam iris 4 or either of the gobo wheels 5,6.

A rotating prism 16 is shown in Figure 7. A prism 15 16 is mounted via bearings allowing it to rotate on the prism holder 69. The drive gear 63 is driven directly by a stepper motor 62 so as to drive the geared rack 64 which in turn is attached to the prism holder 69 which runs on guide rods 68. The mechanism can be positioned so that the prism is either in or out of the beam path. 20 When the prism 16 is concentric to the beam path, i.e. all the way in, the prism is rotated via a friction drive wheel 65 which in turn is driven by the shaft of the stepper motor 61. The rotating prism mechanism is mounted on the rotating prism plate 66 and positioned 25 within the head as shown in Figure 1.

The general arrangement of the cross fade colour system of this invention is most easily seen in Figure 8.

The cross fading colour system shown in Figure 8 30 is made up of three modules 9,10,11 of the primary colours, i.e. Cyan, Magenta and Yellow . Each module 9,10,11 has a pair of dichroic plates of Cyan, Magenta or Yellow.

The outer two plates, i.e. the Magenta and Yellow 35 plates as shown, are arranged at an angle with respect to the Cyan plate. This arrangement ensures that

unwanted reflections generated between the parallel dichroic surfaces and the optical components diverge from the beam path, so preventing unwanted colour hues being transmitted in conjunction with the desired colour.

5 In order to achieve the necessary angle between the plates, each pair of dichroic plates are mounted as shown in Figures 9A and 9B. The outer plates, i.e. the Magenta and Yellow plates as shown, are arranged as 10 shown in Figure 9A, and the middle plates, i.e. the Cyan plates, are arranged as shown in Figure 9B.

15 It is readily apparent that the mounting arrangements for the dichroic plates are similar to the dimmer, frosting and colour tinting systems 13, 14, [] 20 shown in Figure 5. Referring to Figures 9A and 9B, a pair of dichroic plates 75 are mounted on aluminium plates 78 having cut outs. Each plate 78 is attached to a rod 73 which has a short section of geared rack 72 at one end and runs on a bearing block 77 for support 25 at the other end. Each section of rack 72 is meshed with a gear mounted directly to a stepper motor 71. As will easily be appreciated, as the stepper motor 71 is operated, the racks 72 are driven in opposing directions so as to move the pair of dichroic colour 30 plates 75 into and out of the path of the beam. The aluminium plates 78 are constrained to run in track guides 74. The stepper motor 71, track guides 74, and bearing block 77 are mounted on mounting plate 76.

35 In this embodiment of the invention, the aluminium plates 78 which support the Magenta and Yellow dichroic plates are angled, as is most clearly shown in Figure 9A.

30 The securing arrangement for securing the optical components in the second module 3 is shown in Figure 10. All of the above optical components are secured in 35 position by two central locating bars 81a, 81b. The top

bar 81a and locking clip 82 are hinged, so as to ensure the correct alignment of the optical components and to facilitate easy removal and configuration of the lamp.

When the top bar 81a is raised, individual optical

5 components can be easily removed for cleaning or replacement.

Each optical component contains a spring locator 85 at the top and bottom of the optical component,

which are tensioned when the locating bars 81a, 81b are

10 locked in place. This enables the correct position for the optical component to be retained, and also provides mechanical damping and thermal insulation due to the minimal surface contact. The mechanical damping ensures the minimum of vibration damage in transit and 15 prevents resonant noise due to the operation of the stepper motors. This securing arrangement can advantageously be used in any lamp unit.

In this embodiment the various optical components are manufactured in fibreglass and provide the

20 electrical connections 83 from the drive motors to the main motherboard 84, as shown in Figure 10. This minimises the amount of wiring necessary, and also enables easy changes to the lamp configuration to be made as the various optical components identified above 25 can be plugged in various combinations.

Each stepper motor is driven from an individual drive card which plugs into a slot available on the motherboard. The slots correspond to function

positions on the head. Switch means provided on the

30 drive card enables each drive card to drive any of the lamp functions simply by selecting the correct lamp function, i.e. colour wheel, or focus. The address switch provided on the drive card allows the drive card to pick up any of the internal data channels, thus 35 adding to the configurability of the overall unit.

This arrangement is advantageously employed in any lamp

unit.

The copper magnetic ballast of the present invention is shown in Figure 11. In the present invention, the mass of the magnetic ballast has been 5 used as the main structural base for the lamp. The overall weight of the total system can therefore be minimised. In addition, a good thermal conduction path for the heat dissipated within the ballast to the external mounting structure is provided, which 10 minimises the need for forced cooling by a fan. The arrangement of the magnetic ballast as the main structural base for the lamp is useful in any arc lamp.

The head yoke assembly is mounted to the external fixing 93 via a pan ring gear 91 and ballast 92 as 15 shown in Figure 11. This arrangement has a large internal and external diameter, thus allowing easy passage of power and data cables as well as enabling heavy loads to be spread over a much wider area. Thus, with this advantageous head yoke assembly a lamp unit 20 can be mounted on at any angle whilst also minimising the stress applied to the load bearing surfaces. The external fixing 93 for the head yoke assembly is provided with a chamfer 94 on the outer edge thereof so as to enable the head yoke assembly to rotate thereon. 25 The coupling of the drive motor to the pan ring gear 91 is achieved with the addition of drive teeth to the internal or external face enabling the bearing to act as a drive gear and thus minimising unnecessary parts.

CLAIMS

1. A cross-fade system suitable for use in a lamp unit containing a light source which produces a light beam, said cross-fade system comprising at least two colour filter plates each of which is mounted such that it is capable of being moved in a plane across the path of the light beam independently of the other plate or plates thereby to alter the colour of the transmitted light, characterised in that respective planes in which adjacent colour plates move are angled with respect to each other.
- 5 2. A cross-fade system as claimed in claim 1, in which the angle between adjacent colour plates of the system is in the range x to y degrees.
- 10 3. A cross-fade system as claimed in claim 2, in which the angle between adjacent colour plates of the system is in the range a to b degrees.
- 15 4. A cross-fade system as claimed in any preceding claim, in which each colour filter plate comprises a pair of filter shutter elements in the form of a shutter mechanism, a gap being defined between the elements which may be opened and closed by movement of one or other or both of the shutters in the plane of the shutter mechanism.
- 20 5. A lighting instrument for producing a plurality of colours of light from a light source which produces a light beam and comprising a cross-fade system having at least two colour filter plates each of which is mounted such that it is capable of being moved in a plane across the path of the light beam independently of the other plate or plates thereby to alter the colour of the transmitted light, characterised in that respective planes in which adjacent colour plates move are angled with respect to each other.
- 25 6. A lighting instrument comprising a light

source which produces a light beam, said instrument including a housing in which at least one optical component is situated in the path of the beam, characterized in that the or each optical component is 5 resiliently mounted in the housing.

7. A lighting instrument as claimed in claim 6, wherein the or each optical component may be resiliently mounted between oppositely disposed locating means which locate respective formations in 10 the optical component(s).

8. A lighting instrument as claimed in claim 7, wherein each formation in the optical component(s) may comprise a resilient locator means which cooperates with the locating means so as to resiliently mount the 15 or each optical component.

9. A lighting instrument as claimed in claim 8, in which the resilient locator means is arranged so as to bridge a recess in the at least one optical component.

20 10. A lighting instrument as claimed in claim 7 or 8, in which the resilient locator means comprises a spring in extension.

11. A lighting instrument as claimed in one of claims 6-10, in which at least one of the locating 25 means is movable away from a position in which the or each optical component is resiliently mounted.

12. A lighting instrument as claimed in one of claims 6-11, wherein the or each movable locating means is provided with a locking mechanism to lock it in 30 position in which the or each optical component is resiliently mounted.

13. A lighting instrument as claimed in one of claims 6-12, wherein at least one of the optical components located in the path of the beam may be 35 provided with integral electrical circuitry which terminates in suitable contacts which permit connection

of a drive means such as a motor associated with that optical component to the main electrical circuitry in the lighting unit.

14. A lamp unit, comprising a lamp bulb and
5 optical components, characterised in that the arc lamp is situated in a first housing which is thermally isolated from a second housing which houses the optical components. As a result, the influence of heat generated by the lamp bulb on the optical components is
10 reduced.

15. A lamp unit as claimed in claim 14, wherein the arc lamp bulb is also cooled by a remotely situated fan supplying ducted air to the arc lamp.

16. A lamp unit as claimed in claim 15, in which
15 the remotely situated fan supplying ducted air to the arc lamp bulb is mounted in the housing which houses the optical components.

17. A lamp unit as claimed in one of claims 14-
16, in which the housing which houses the bulb is a
20 metal casting provided with fins.

18. A lamp unit as claimed in one of claims 14-
17, in which thermally insulating material is provided between the first housing which houses the lamp and the housing which houses the optical components.

25 19. A lamp unit as claimed in one of claims 14-
18, in which the optical components are thermally isolated from the arc lamp bulb by a curtain of air between the bulb housing and the housing for the optical components.

30 20. A lamp unit as claimed in claim 14, in which the optical components are thermally isolated from the arc lamp bulb by a curtain of air between the bulb housing and the housing for the optical components and the arc lamp bulb is also cooled by a remotely situated
35 fan supplying ducted air to the arc lamp, the air curtain being created by the ducted air from the fan.

21. An arc lamp unit comprising a lamp housing movably mounted on a base a copper magnetic ballast being provided to ensure the provision of the correct drive voltage and current to the lamp, characterised in 5 that the copper magnetic ballast forms part of the base of the lamp unit.

22. A lamp unit substantially as herein described with reference to the accompanying drawings.



The
Patent
Office

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Application No: GB 9618628.3
Claims searched: 1 to 5

Examiner: Graham S. Lynch
Date of search: 13 November 1997

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): F4R (RCK, RFM)

Int Cl (Ed.6): F21P 3/00, 5/00, 5/02, 5/04; F21V 9/08, 9/10

Other:

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X	EP 0352755 A2 MOPHEUS LIGHTS, INC. Column 2, lines 23 to 45. Column 4, lines 24 to 36. Figures 1, 2.	1 - 3, 5
X	US 5188452 RYAN. Column 6, lines 24 to 34.	1 - 5

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

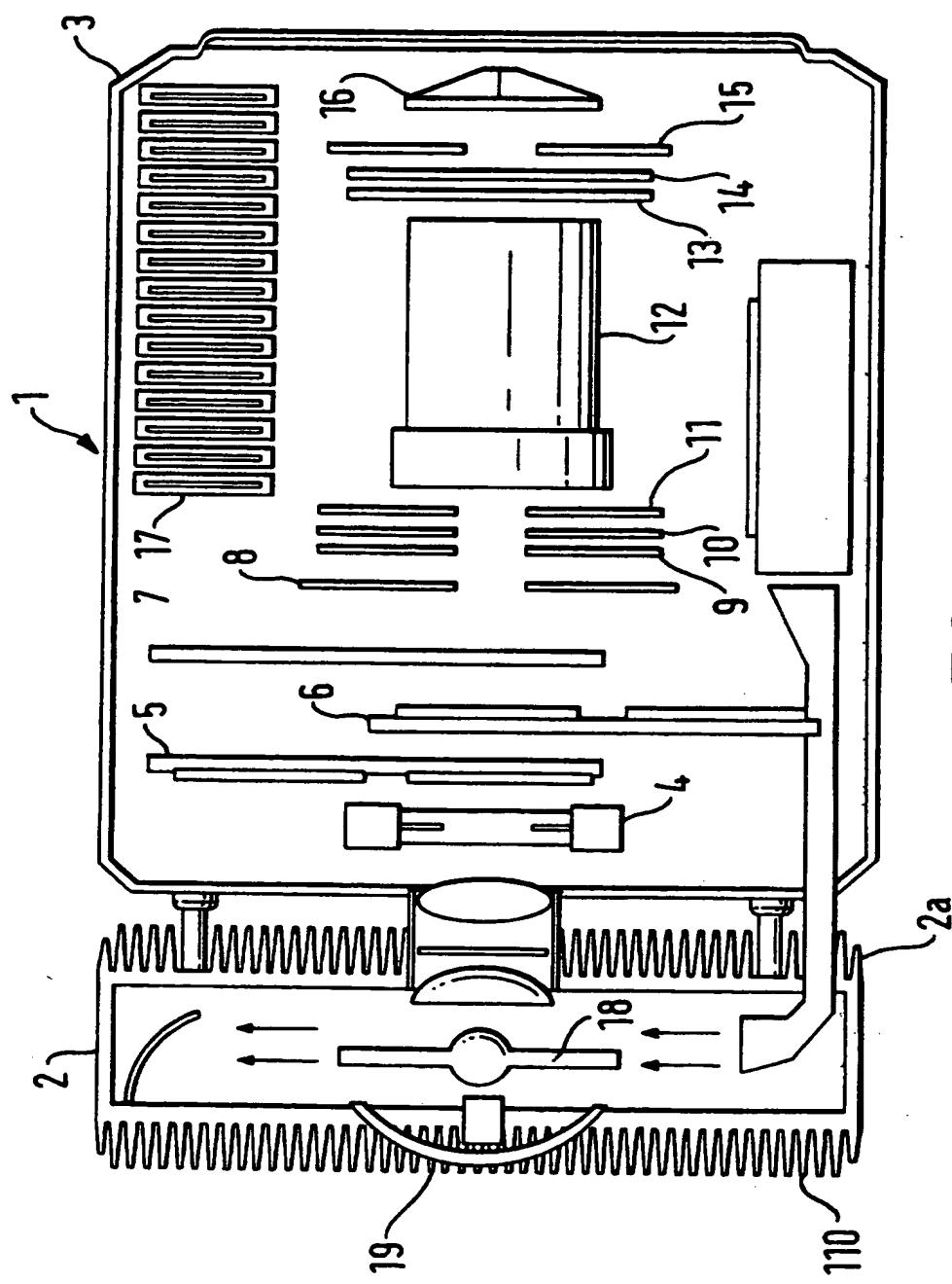
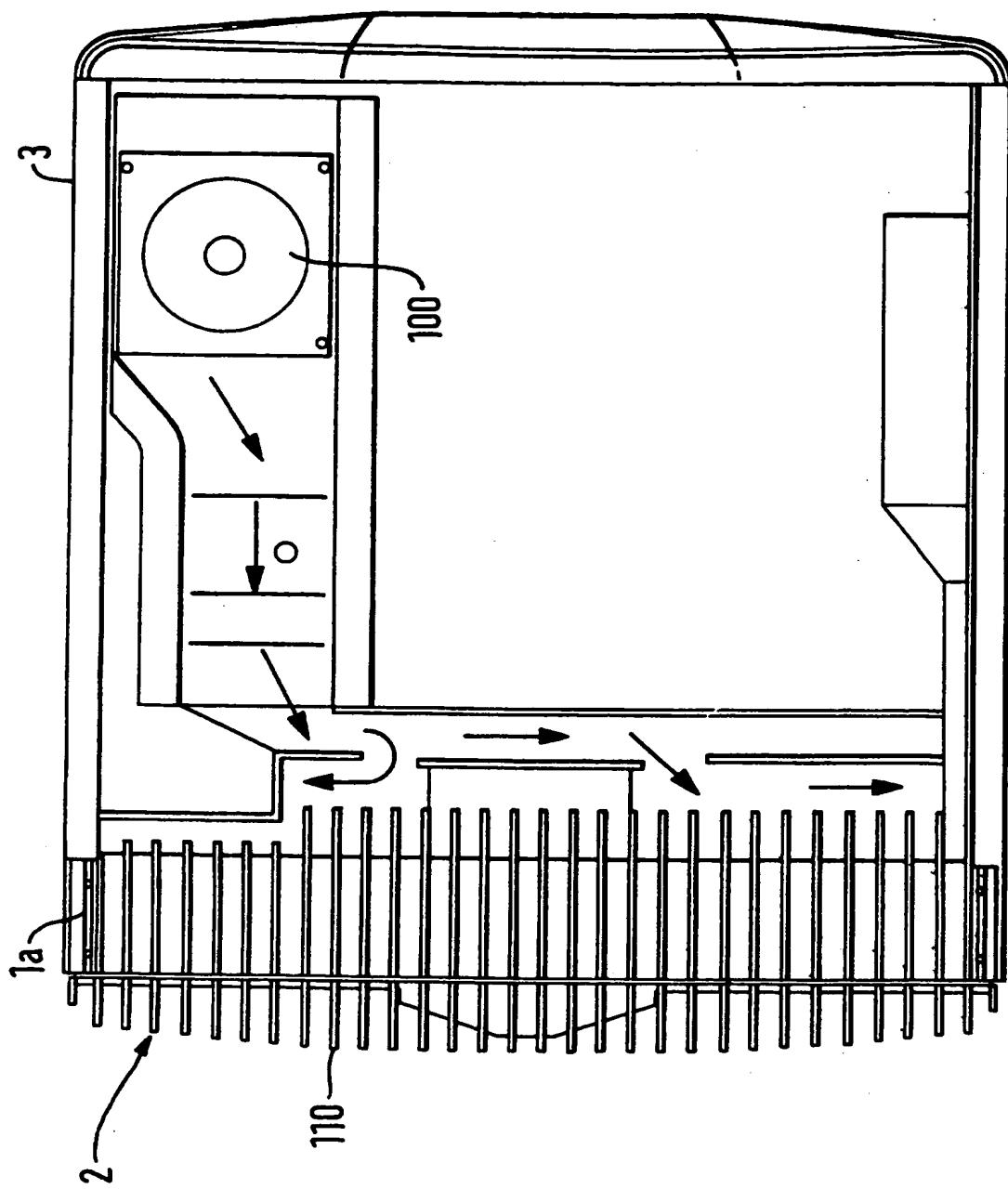


FIG. 1A

FIG. 1B



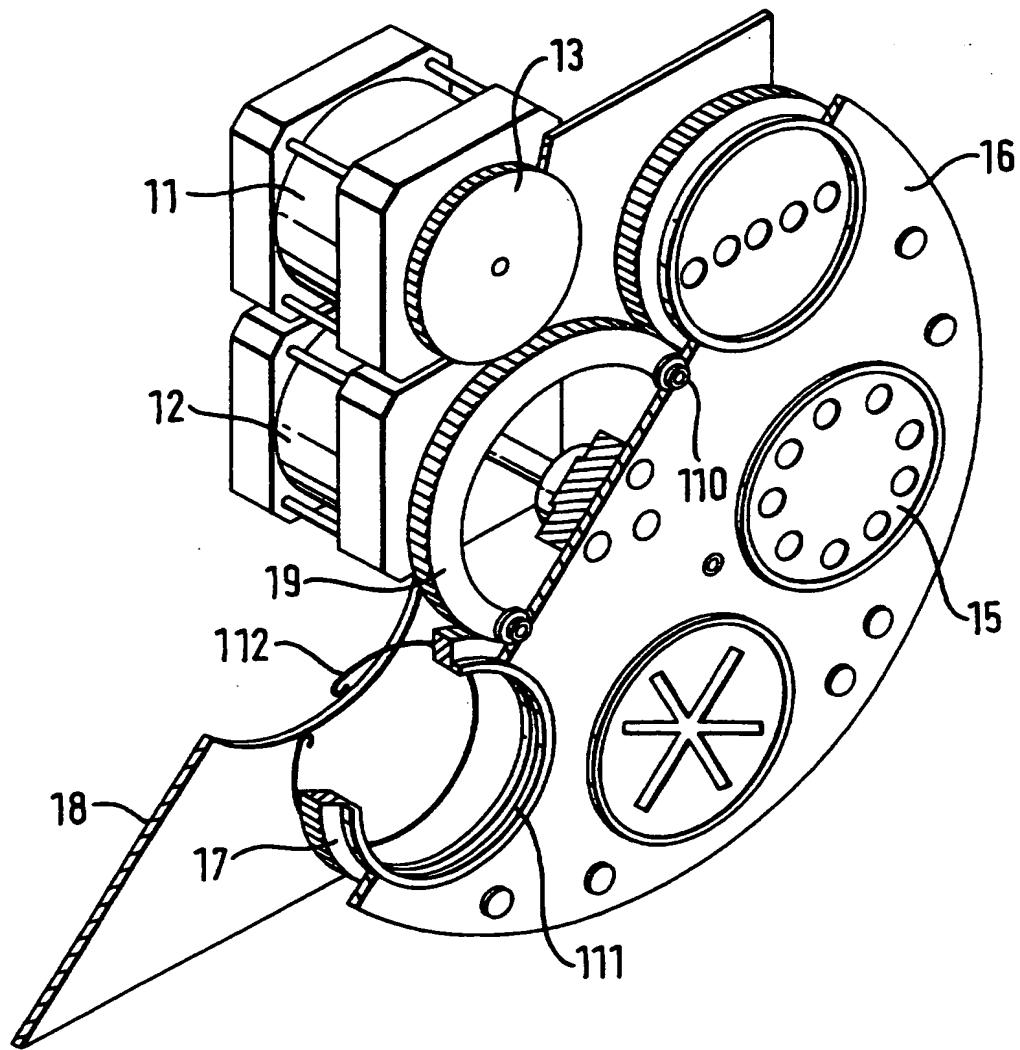


FIG. 2

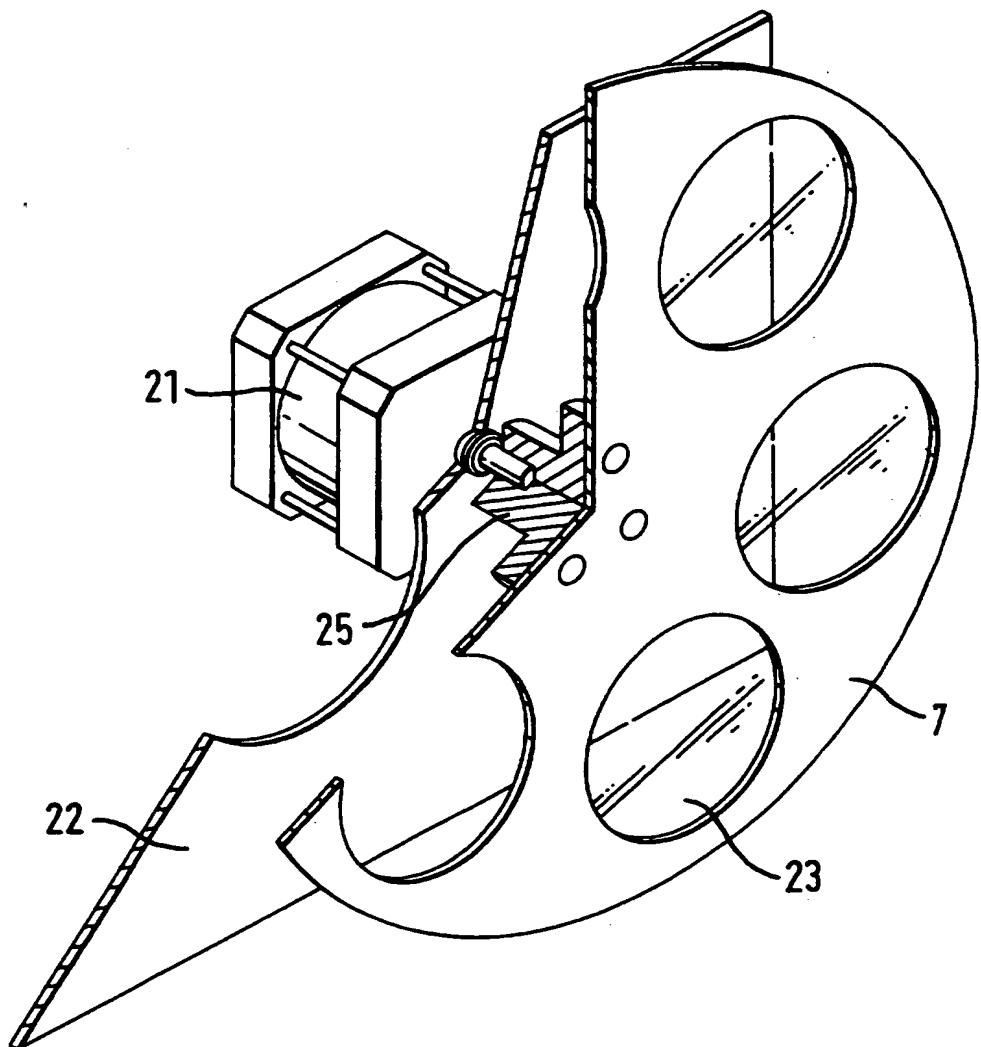


FIG. 3

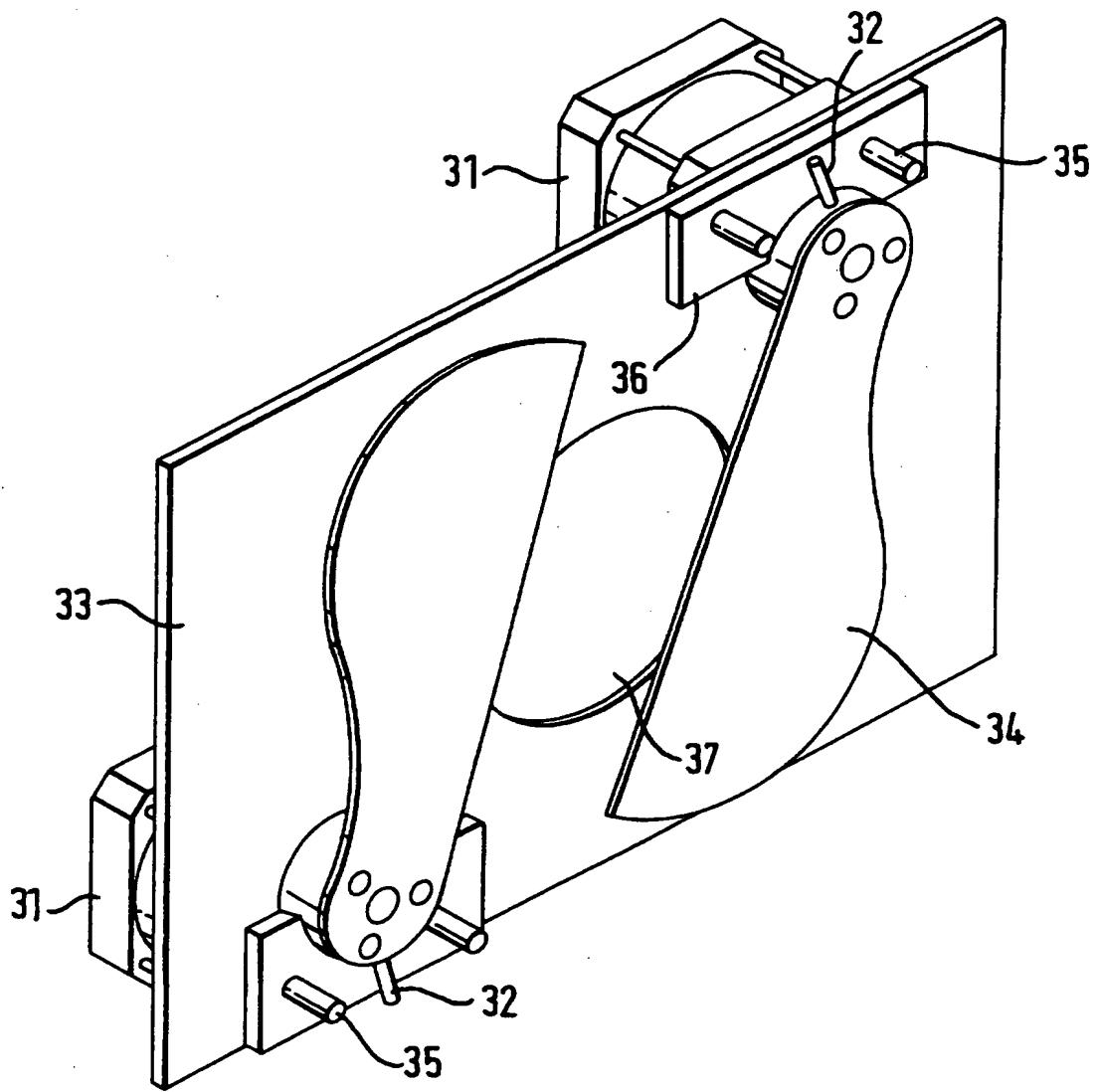


FIG. 4

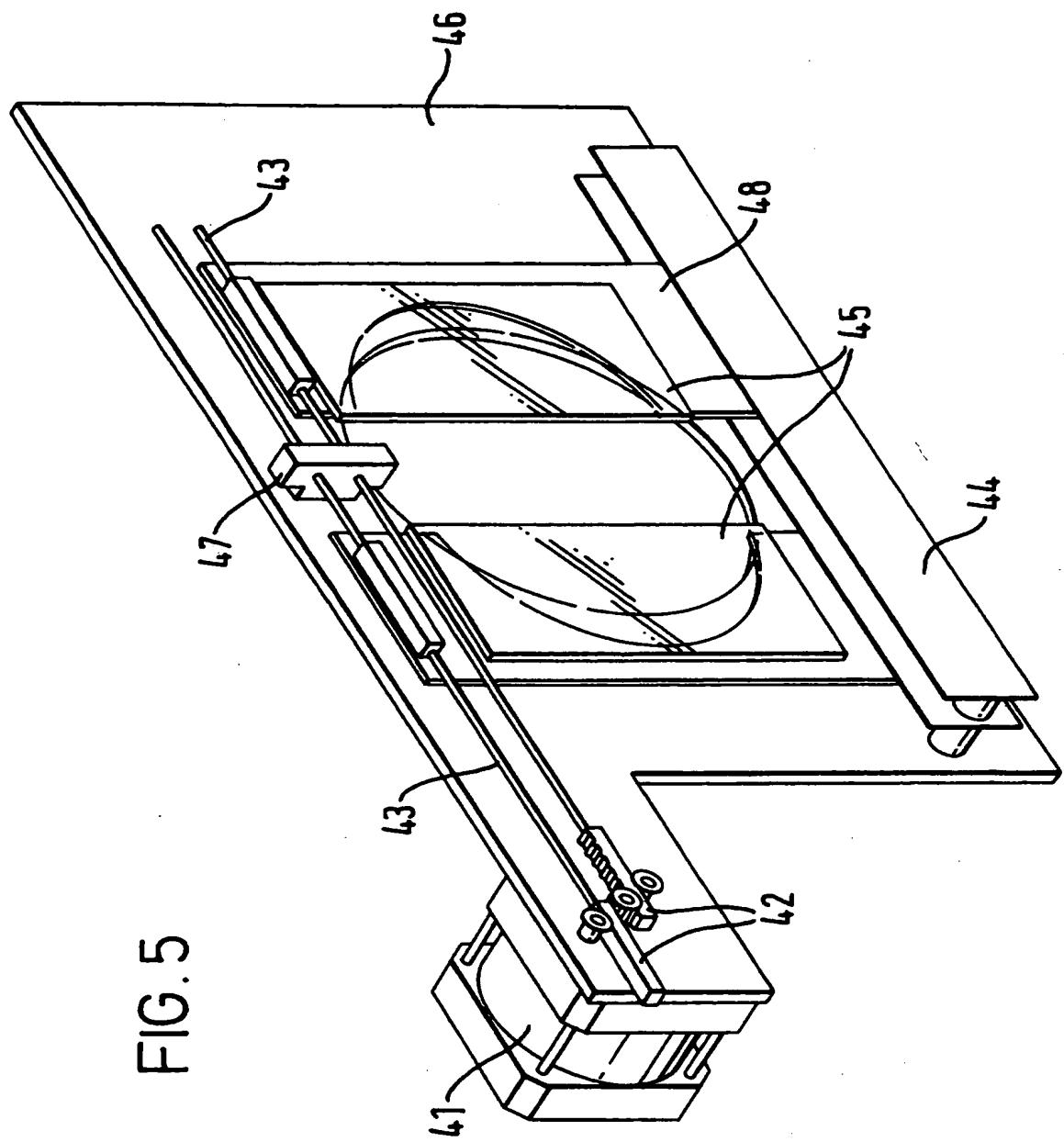


FIG. 5

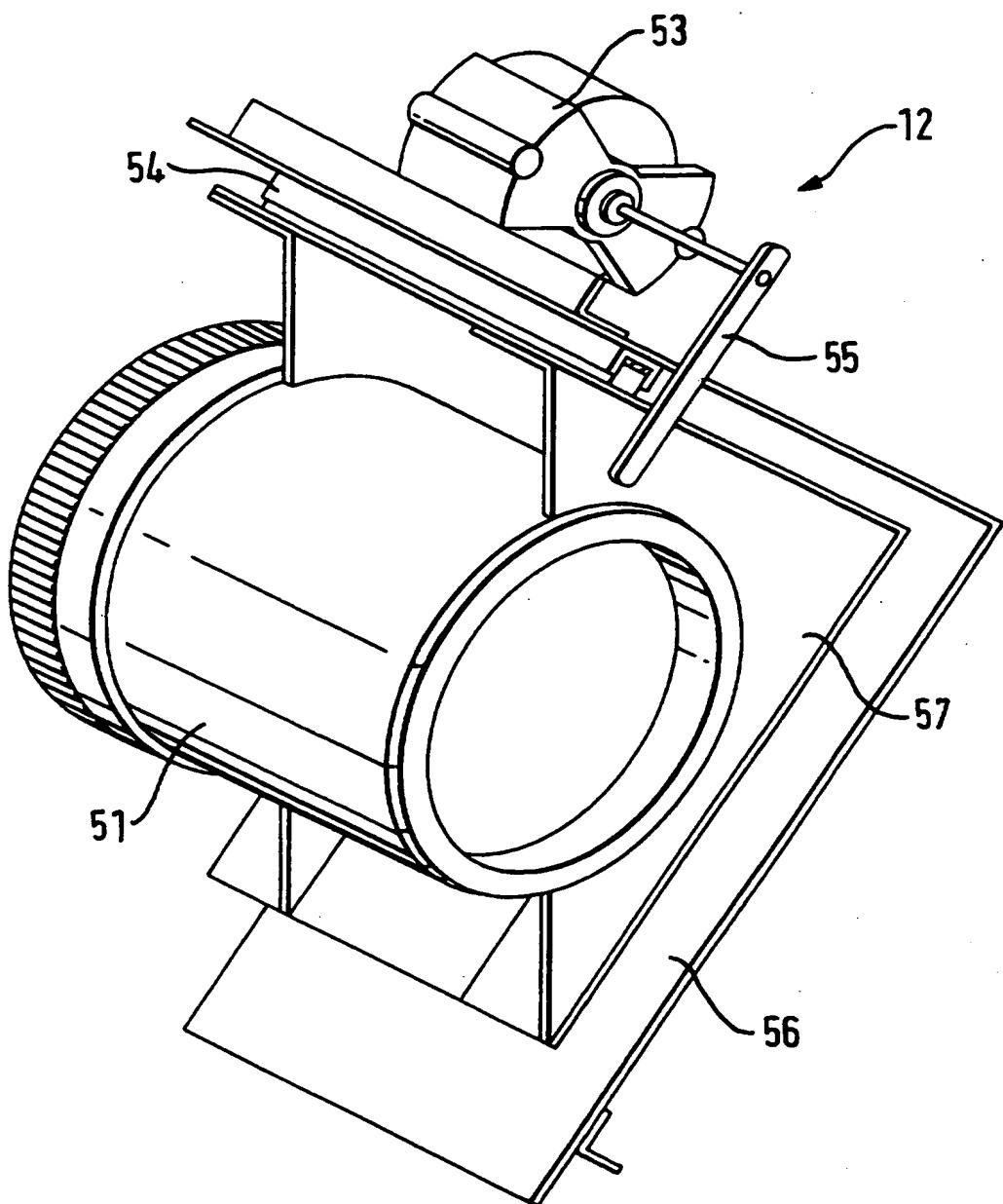


FIG. 6

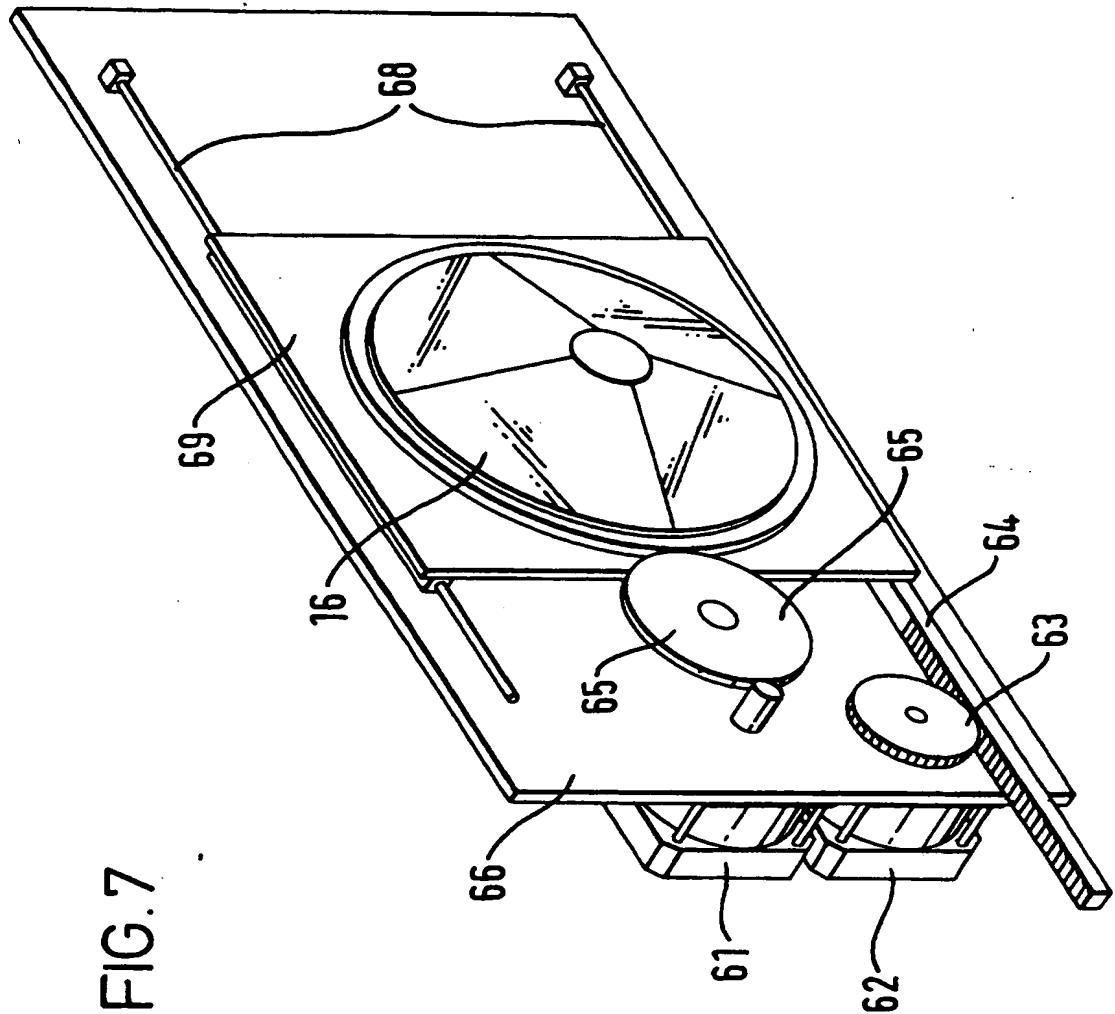
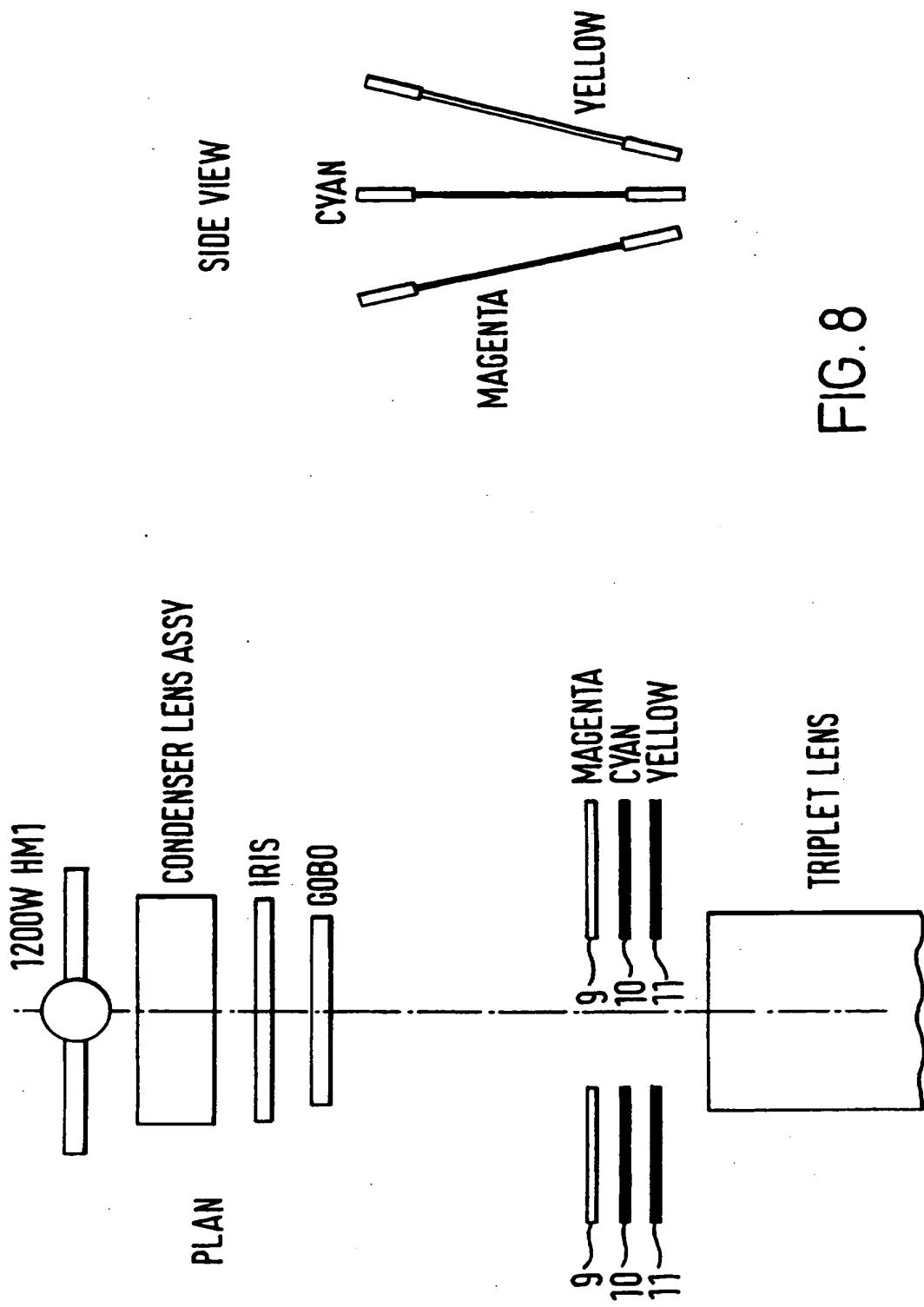


FIG. 7

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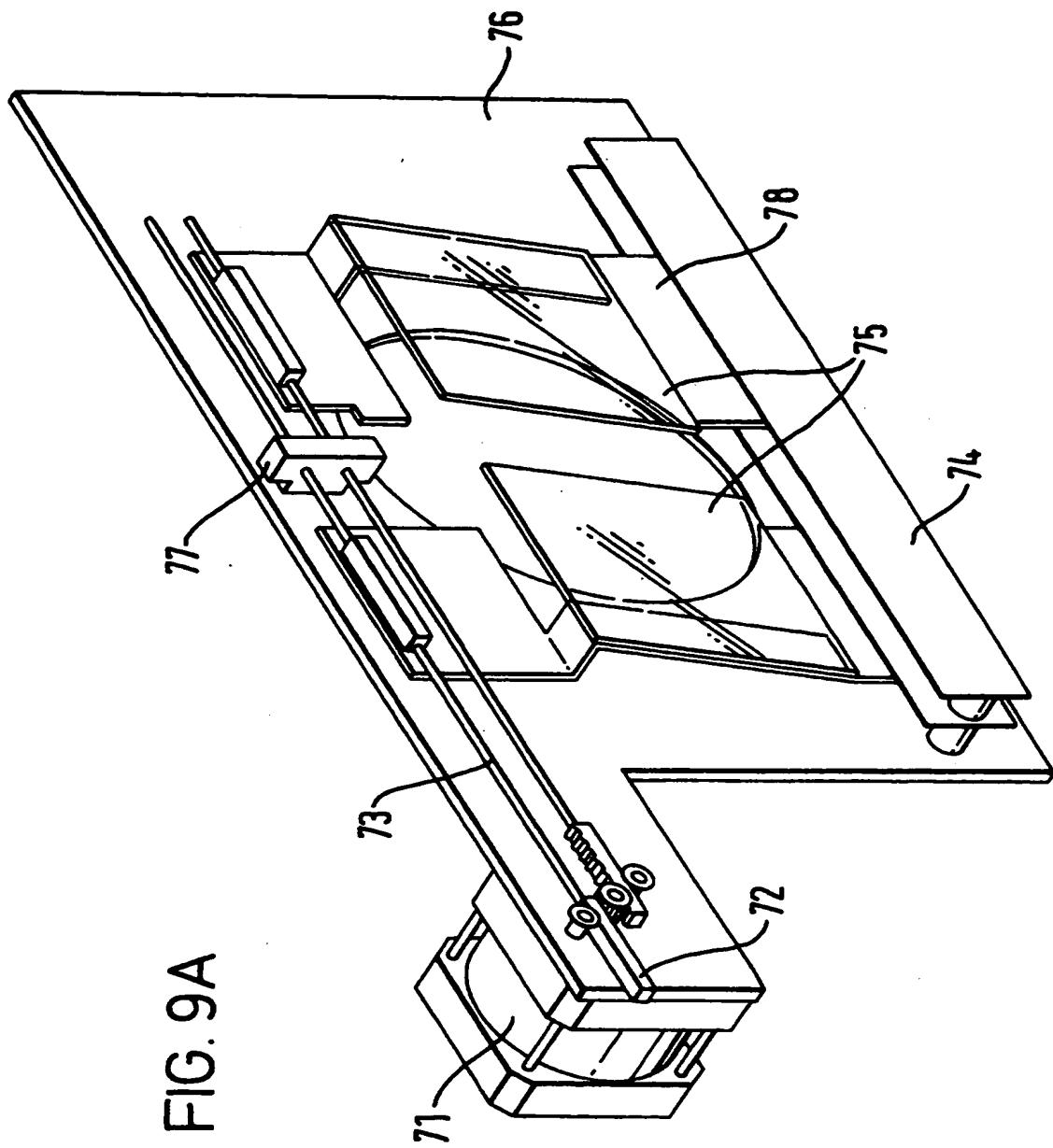


FIG. 9A

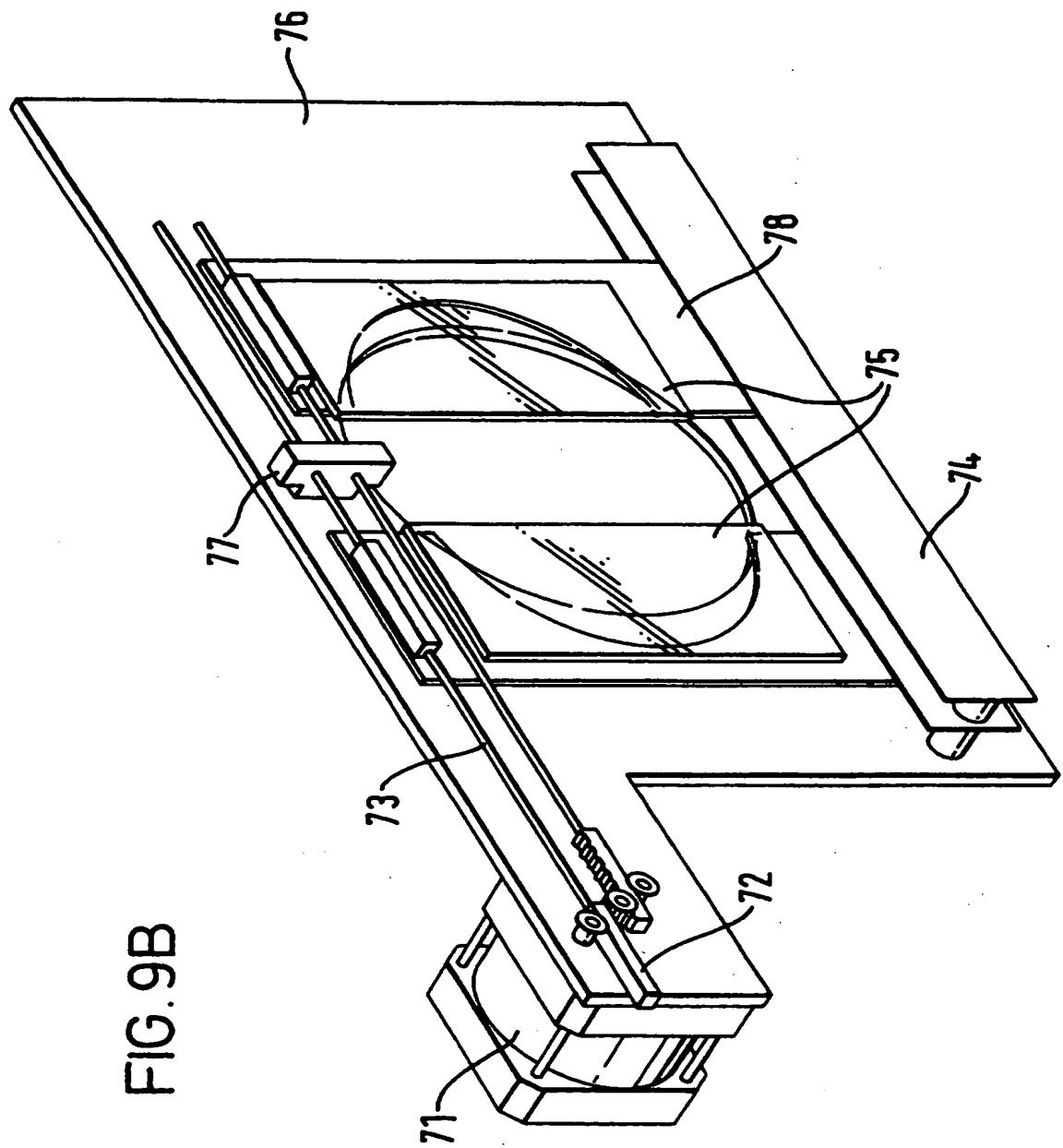
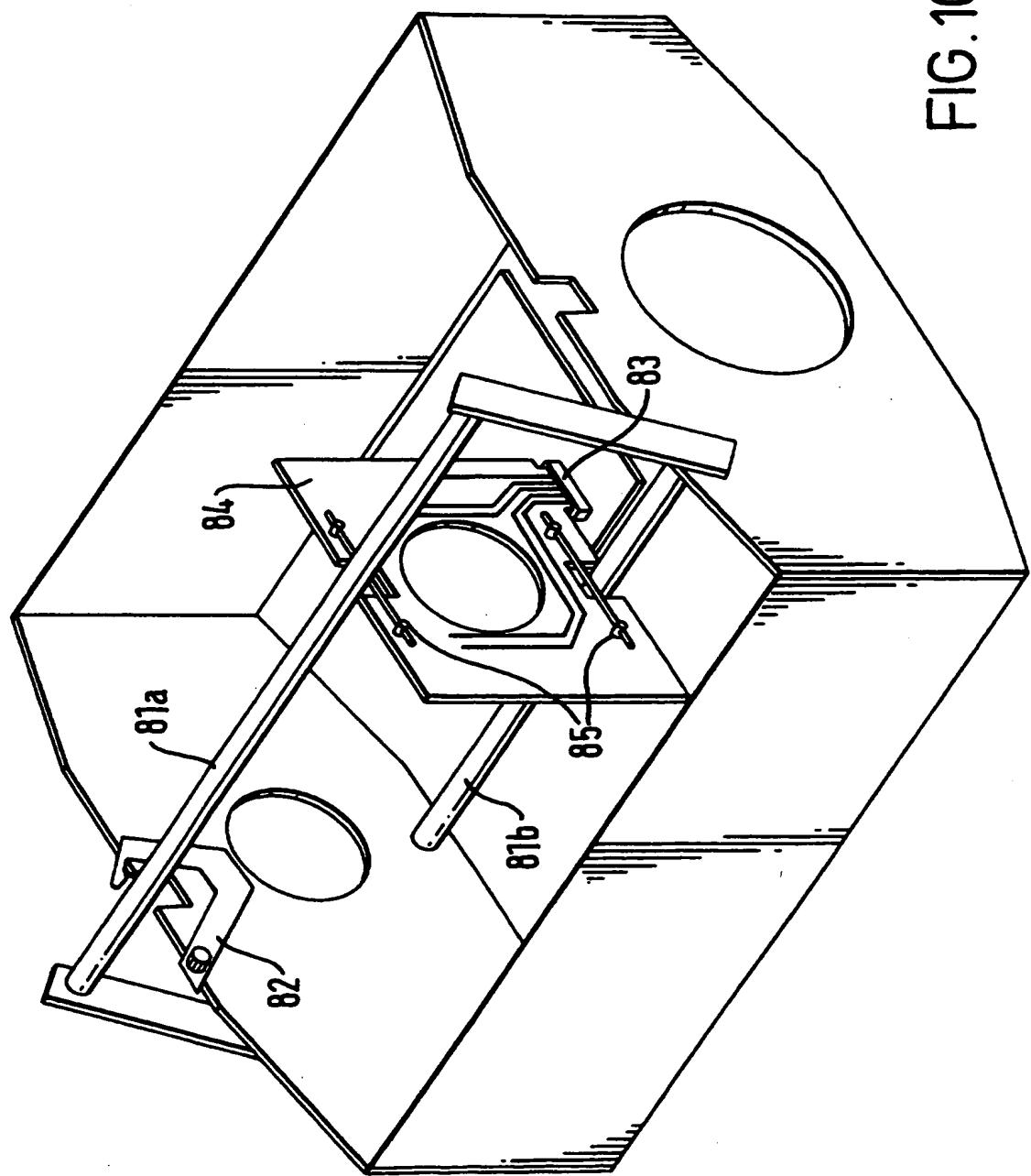


FIG. 9B

FIG. 10



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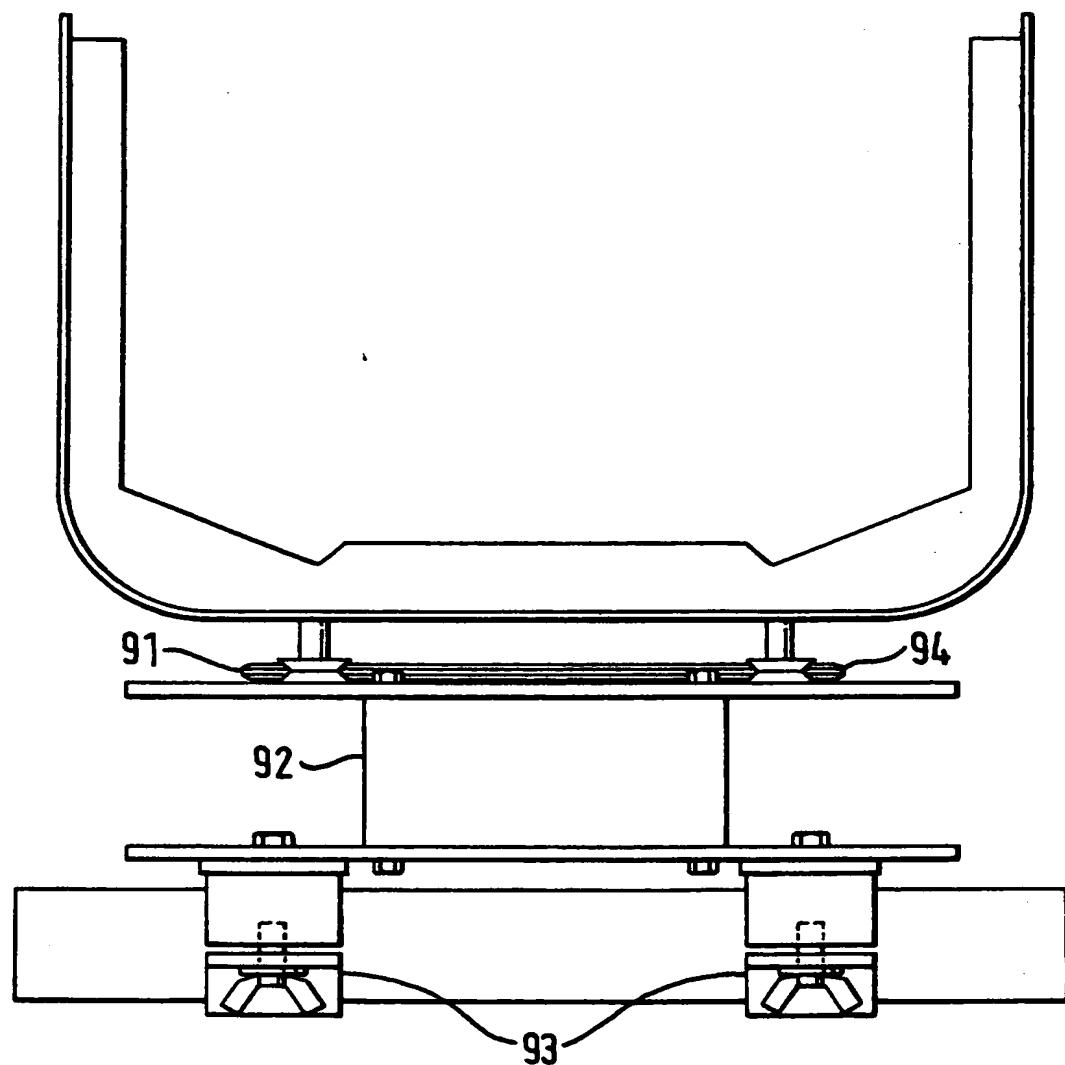


FIG. 11

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